NEW DESCRIPTION

SPECIES DIVERSITY OF GENUS *MICROLEJEUNEA* STEPH. (LEJEUNEACEAE, HEPATICAE) IN NILGIRI HILLS, WESTERN GHATS, TAMIL NADU, INDIA

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A survey of *Microlejeunea* Steph. (Lejeuneaceae) from the Nilgiri hills, Western Ghats, Tamil Nadu, India, is presented with *M. udari* described as a new species. *Microlejeunea punctiformis* and *M. ulicina* reported for the area are also discussed.

Key words: Bryophyta, Hepaticae, India, Lejeuneaceae, *Microlejeunea*, Tamil Nadu, Taxonomy

INTRODUCTION

The genus *Microlejeunea* Steph., as the name implies, includes highly reduced species among the members of the Lejeuneaceae and is distributed in tropical as well as temperate parts of the world. The genus is extremely delicate (often polymorphic) and needs specialized microclimate. About 80 species are described across the world, most of them described by Stephani (1915). The taxonomic position of the genus always remains difficult. Mizutani (1961) was followed by Schuster (1980) who treated *Microlejeunea* as a subgenus of *Lejeunea* Lib., while Vanden Berghen (1948) was followed by Gradstein (1979) who separated *Microlejeunea* from *Lejeunea* on the basis of relatively small size and appearance of plant along with large size of leaf-lobule, and treated *Microlejeunea* as genus. *Microlejeunea* is characterized by small-sized plant, stem never exceeds 7 cortical and 3 medullary cells, while the leaf lobule covering 3/4 leaf lobe area, leaf and leaf-lobule always parallel with stem, never spreading, often with 1-2 ocelli, cells thick-walled and without trigones.

Earlier, 8 species of *Microlejeunea* were reported from India, including *M. aligera* (Mitt.) Steph. (now *Lejeunea aligera* Mitt.), *M. gracillima* Mitt. (name unresolved: http://www.theplantlist.org/tpl/record/tro-35209681) (now *M. punctiformis* (Taylor) Spruce), *M. longirostris* Steph. (now *L. longirostris* (Steph.) E.W. Jones), *M. inflatiloba* Steph., *M. microstipula* Steph., *M. minutistipula* Steph., *M. ulicina* (Taylor) A. Evans and *M. punctiformis* (Taylor) Spruce (Stephani 1915; Agarwal 1986). The Nilgiri hills, in the present state of our knowledge, host three species, *M. punctiformis, M. udari* and *M. ulicina*, the second described here as a new species from Pykara (Nilgiri hills), and subsequently collected from Porthimund Reserve Forests of the Western Ghats – a hotspot of global biodiversity. The species is easily separable from other known species.

Key to the species of *Microlejeunea* in the Nilgiri Hills

1. Plants 0.1-0.19 mm wide, underleaves as wide as the stem, female bract with entire margin 2
— Plants 0.19-0.3 mm wide, underleaves twice as wide as the stem, female bract with dentate margin .. *M. udari* sp. nov.
2. Leaf-lobe with a sub-acute apex ..... *M. punctiformis*
— Leaf-lobe with a rounded apex ..... *M. ulicina*

1. *Microlejeunea punctiformis* (Taylor) Spruce (Fig. 1)

In: Steph., Sp. Hep. 5: 832. 1915—*Lejeunea punctiformis* Taylor, *In*: Gottsche., Lindenb. *et* Nees, Syn. Hepat. 767. 1847.

Plants prostrate (isolated), yellowish-green, up to 7-10 mm long, 0.42-0.5 mm wide, shoot zigzag in appearance. Growth habit deliquescent, ramification pattern irregularly pinnate. Branching '*Lejeunea*-type'. Stem 32-38 µm in diameter, 3 cells across, differentiated, with 7 large cortical cells and 3 small medullary cells. Leaves contiguous, obliquely inserted, erect spreading, parallel to stem. Leaf-lobes ovate-oblong, 0.18-0.26 mm long, 0.9-0.15 mm wide, apex subacute, margin entire. Leaf cells thin-walled, apical and median cells 5-13 x 6-10 µm, basal cells 8-13 x 6-12 µm, ocelli 1 or 2 at basal cells. Leaf lobules large, 3/4 of the lobe length, first tooth only single celled, slightly acute. Underleaves small, distantly as wide as stem, bifid, 1/2 of their length, sinus deep, lobe triangular, subacute. Plants sterile.

Type Locality: southern India (*sic* Stephani, 1915).

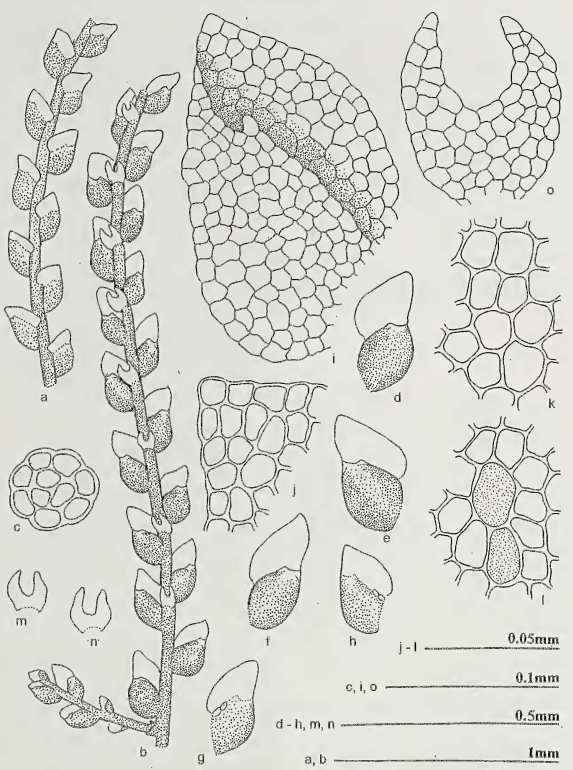

Fig. 1: *Microlejeunea punctiformis* (Taylor) Spruce (a-o from *Srivastava and party* 12636, LWU)
a: Plant, dorsal view, b: Plant, ventral view, c: Cross section of stem, d-h: Leaves, i: Leaf, magnified, j: Apical cells of leaf-lobe, k: Median cells of leaf-lobe, l: Basal cells of leaf lobe showing ocelli, m and n: Underleaves, o: Underleaves, magnified

Range: ASIA: India, Japan (Furuki and Mizutani 1994; Mizutani 1971).

Distribution: INDIA: Eastern Himalaya: Arunachal Pradesh; Sikkim – Nathu La Road; Manipur – Ukhrul; West Bengal – Darjeeling (Rimbic). southern India: Western Ghats: Karnataka – Mercara; Kerala – Ponmudi; Tamil Nadu – Nilgiri hills [Ootacamund (Emerald, Government Botanical Garden)].

Habitat: The species grows in thread-like forms (mainly diffuse patches) as epiphytic population on the bark of trees.

Representative Specimens Examined: JAPAN: Kyushu

– Miyazaki, Nakagol, 400 m, bark of *Cryptomeria japonica*, 1950, Coll.: S. Hattori, 141 (Hepaticae Japonicae). INDIA: Western Ghats: Tamil Nadu: Nilgiri hills, Ootacamund, Emerald, 1,800-1,900 m, 1983, Coll.: R. Udar and party 7079 (LWU). Ootacamund, Government Botanical Garden, 2,250 m, 2000, Coll.: S.C. Srivastava and party, 12636 (LWU).

Microlejeunea punctiformis is characterized by sparsely branched plants, leaves ovate-oblong with subacute apex, leaf-lobule covering 2/3 of the lobe. The species is similar to *M. ulicina* in overall characters, except in leaf morphology. The leaf apex is subacute in the former while rounded in the latter. Mizutani (1971) stated that both the taxa may be conspecific, but after the study of several collections from different Indian localities we here conclude that both species are easily separable.

2. *Microlejeunea udari* sp. nov. (Fig. 2)

Plantae dioeciae, caulibus prostratis ad 7 mm longis irregulariter pinnatis. Folia contigua ad subimbricata, loborum margo posticus arcuatus leniter crenulatus, cellulae basales 25-32 µm longae 16-20 µm latae, apicales 13-18 µm longae 16-21 µm latae ocelli cellulis vicinis parum maiores, lobuli 3/4-plo lobi longitudine inflate ovati. Gynoecia intercalaria. Folia floralia orbicularia, lobis obovatis margine dentate saepe crenulato dentibus 2 vel 3 cellulis longis apice acuto, lobulis oblongis ad lingulatis. Perianthium obovatum.

Typus: INDIA: Tamil Nadu: Nilgiri hills – Ootacamund, Pykara, 2,100 m, 29.iii.2001; Coll.: P.K. Verma and A. Alam, 13636 (Holotype LWU).

Paratypes: INDIA: Western Ghats, Tamil Nadu, Porthimund Reserve Forest, 2,200 m, on angiosperms, Coll.: P.K. Verma, 18035/2005 (Paratype LWU).

Plants prostrate pale green to dark green, up to 7 mm long, 0.49 mm wide. Growth habit deliquescent, ramification pattern irregularly pinnate. Branching '*Lejeunea*-type'. Stem 4 cells across the diameter with 7 large cortical cells and 3 small medullary cells. Leaves remote, contiguous to subimbricate, obliquely inserted, sub-erect spreading. Leaf-lobes ovate, flat, 0.29-0.36 mm long, 0.20-0.32 mm wide, apex rounded, antical and postical margin arched, margin weakly crenulate. Cells thick-walled, apical cells 13-18 x 16-21 µm, median cells polygonal 16-24 x 13-18 µm, basal cells 25-32 x 16-20 µm, ocelli slightly large, 30-34 x 22-26 µm, larger than neighbouring cells. Leaf-lobules large, 3/4 of the lobe length, keel strongly convex, inflated, ovate, 0.15-0.18 mm long, 0.12-0.15 mm wide, apical tooth 1-celled, not curved, margin crenulate. Underleaves twice as wide as stem, distant, sub-transversely inserted, orbicular, 0.06-0.09 x 0.06-0.09 mm, bilobed, 1/2 of the lobe length, lobe triangular and acute. Dioecious. Androecia not seen. Gynoecia intercalary in position, gynoecial innovation single, inflorescence pattern monochasial. Female bracts in single pair. Bract-lobes obovate, 0.6-0.62 mm long, 0.42-0.48 mm wide, long keel with an irregular sinuous wing, margin dentate, often crenulate with 2-3 cells long dentitions. Bract-lobules oblong to lingulate, 0.5-0.54 mm long, 0.2-0.26 mm wide, triangular, acute at apex. Bracteoles oblong, 0.3-0.32 mm long, 0.12-0.14 mm wide, shallowly bifid, lobes divergent, margin irregularly crenate with 1-2 celled teeth. Perianth obovate, 0.5-0.54 mm long, 0.26-0.28 mm wide, 5-keeled. Sporophyte not seen.

Type Locality: INDIA: Western Ghats, Nilgiri hills.

Range: Endemic to India.

Distribution: INDIA: southern India: Tamil Nadu, Nilgiri hills [Ootacamund (Pykara), Porthimund Reserve Forest].

Habitat: Plants growing in thread-like forms (in loose patches) as epiphytic population on bark of angiosperms.

Characteristics of the New Species:

1. Plants pale green to dark green.
2. Leaves contiguous to subimbricate, margin crenulate.
3. Leaf lobule inflated, ovate, 2/3 of the lobe length.
4. Underleaves twice as wide as stem, bifid, 1/2 of the lobe length.
5. Dioecious.
6. Female bracteole connate on both sides of bracts, margin of bracts and bracteole irregularly and highly crenulate.

Microlejeunea udari sp. nov. is a distinctive species recorded from Pykara and Porthimund Reserve Forest of Nilgiri hills. The species is different from *M. ulicina* and *M. punctiformis* in the structure of female bracts. *M. udari* sp. nov. has irregularly dentate bract margin with 1- or 2-celled protruding teeth and underleaves twice wide as stem, while the other two species have entire margin of the bract and the underleaves are as wide as stem.

Etymology: The *Microlejeunea udari* is named as a token of respect for the teacher of the one of the authors (Surech C. Srivastava), Prof. Ram Udar, FNA and renowned bryologist of the country.

3. *Microlejeunea ulicina* (Taylor) A. Evans (Fig. 3)
Mem. Torrey Bot. Club. 8: 162, 165, 176. 1902.

Plants prostrate (isolated), pale yellowish to green, up to 10 mm long, 0.3 mm wide; shoot zigzag in appearance.

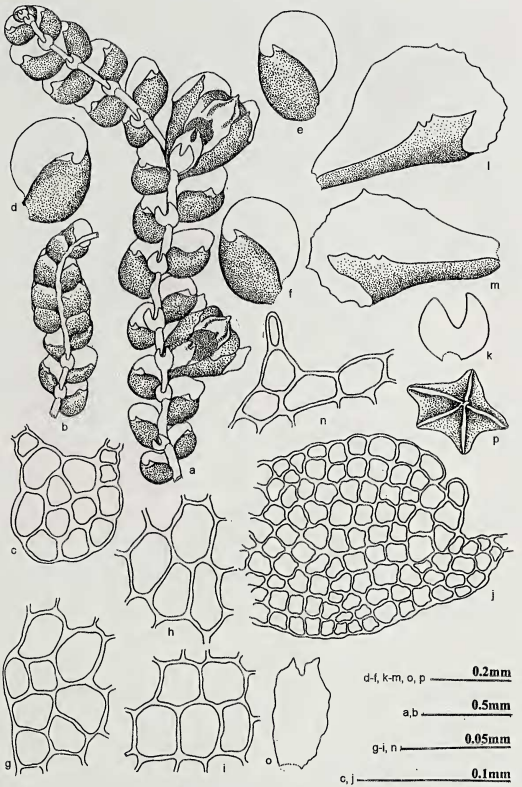

Fig. 2: *Microlejeunea udari* sp. nov.
a: Female plant, ventral view, b: Male branch, ventral view, c: Cross section of stem, d and f: Leaves, g: Apical cells of leaf-lobe, h: Median cells of leaf-lobe, i: Basal cells of leaf-lobe, j: Leaf-lobule, magnified, k: Underleaf, l and m: Female bracts, n: Marginal cells of female bract, o: Female bracteole, p: Cross section of perianth

Growth habit deliquescent, ramification pattern irregularly pinnate. Branching '*Lejeunea*-type'. Stem 29-34 µm in diameter, 3 cells across the diameter, with 7 relatively large cortical cells and 3 small medullary cells. Rhizoids arising from underleaf base. Leaves contiguous, obliquely inserted, sub-erect spreading. Leaf-lobes ovate, strongly convex, 0.13-0.19 mm long, 0.12-0.19 mm wide, apex rounded, margin entire. Cells sub-quadrate, thick-walled, apical cells 3-6 x 3-6 µm, median cells 5-9 x 5-8 µm, basal cells 7-12 x 6-8 µm, ocelli 1-2, similar to adjoining cells. Leaf-lobules large, 3/4

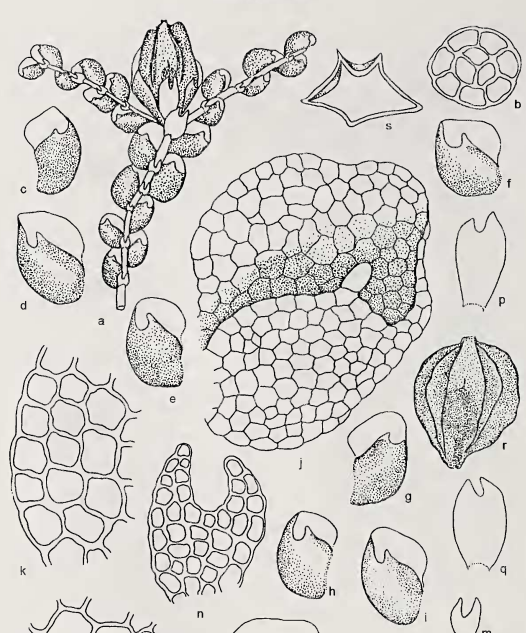

Fig. 3: *Microlejeunea ulicina* (Taylor) A. Evans (a-s from Srivastava and party 12510, LWU)
a: Female plant, ventral view, b: Cross section of stem, c-i: Leaves, j. Leaf, cellular, k: Apical-marginal cells of leaf-lobe, l: Median cells of leaf-lobe. m: Underleaf, n: Same, magnified, o: Female bract, p and q: Female bracteole, r: Perianth, s: Cross section of Perianth

of the lobe length, first tooth only single celled, obtuse. Underleaves as wide as stem, bifid, 1/2 of their length, 48-70 µm long, 42-53 µm wide, lobes narrow, 3 cells long, 2 cells wide. Dioecious. Androecia not seen. Gynoecia terminal on main shoot as well as on short lateral branches, gynoecial innovation 1 or 2, inflorescence diffuse. Female bracts much larger than leaves. Bract-lobes obovate-oblong, 0.33-0.37 mm long, 0.19-0.22 mm wide, apex rounded, margin entire, bract-lobule irregular in shape, oblong, apex rounded. Bracteoles free from bract, obovate to oblong,

0.27 mm long, 0.13 mm wide, bifid. Perianth inflated, obovoid, 0.45-0.78 mm long, 0.32-0.40 mm wide, smooth, 5-keeled. Sporophyte young.

Type Locality: Ireland: Kerry county – Kenmore (Schuster, 1980)

Range: AFRICA: Ivory Coast; U.S.A.: Canada, SOUTH AMERICA: Brazil, Chile; ASIA: Japan; EUROPE: Azores, Britain, France, Italy, Luxembourg, Madeira, Canary Isle (Mizutani 1979; Zhu and So 2001).

Distribution in India: Eastern Himalaya: Meghalaya – Kanchipur, Vishnupur; Sikkim – Nathu La road. southern India: Western Ghats: Karnataka – Agumbe, Jog falls; Kerala – Lakkidi, Ponmudi, Silent Valley; Tamil Nadu - Nilgiri hills [Gudulur (Anumapuram, Cherambadi, Nellakotta, on way to Frog hill point to Wilson plantation, Naduvattam Reserve forest, on way to Yellamalai, Pandalur), Kotagiri (Elada, Kilkotagiri, on way to Kodnad, Nedgula, Quin Sholai, Shollarmattum, St. Catherine waterfall), Mukurthi National Park (Governorsholai, on way to Mukurthi lake, Parson's valley), Ootacamund (Athecal, Dodabetta, Government Botanical Garden, Kamraj Sagar Reserve Forest, Kendurai, Love Dale, Glenmorgan, Melkahatty, on way to Pykara water fall, Sholur, Theetkul), Upper Bhavani (Avalanche) (Agarwal 1986)].

Habitat: The species grows in thread-like form as epiphytic population on bark of trees.

Representative Specimens Examined: INDIA: Western Ghats, Tamil Nadu, Nilgiri hills, Ootacamund, Dodabetta, 2,660 m, 2000, Coll.: S.C. Srivastava and party, 12417, 12419, 12421, 12424, 12425, 12427 (LWU). Upper Bhawani, Avalanche, 2,250 m, 2000, Coll.: S.C. Srivastava and party, 12529, 12569, 12570, 12571, 12577, 12578 (LWU). Ootacamund, Government Botanical Garden, 2,250 m, 2000, Coll.: S.C. Srivastava and party, 12603, 12623 (LWU). Kotagiri, Kilkotagiri, 1,900 m, 2001, Coll.: P.K. Verma and A. Alam, 14335, 14337, 14339, 14344, 14347, 14349, 14366, 14372 (LWU). Ootacamund, Pykara waterfall, 2,100-2,200 m, 2001, Coll.: P.K. Verma and A. Alam, 14455, 14456, 14458, 14448, 14476, 14482, 14490 (LWU). Gudulur, Anumapuram, 2,100 m, 2001, Coll.: P.K. Verma and A. Alam, 14511, 14514, 14515, 14524, 14525 (LWU). Mukurthi National Park, on way to Mukurthi lake, 2,250 m, 2001, Coll.: P.K. Verma and A. Alam, 14541, 14553, 14554 (LWU). Ootacamund, Glenmorgan, 2,200 m, 2001, Coll.: P.K. Verma and A. Alam, 14678 (LWU). Gudulur, Nellakotta, 1,200-1,400 m, 2002, Coll.: P.K. Verma, A. Alam and N. Sahu, 14886, 14903, (LWU). Mukurthi National Park, Parson's valley, 2,250 m, 2002, Coll.: P.K. Verma, A. Alam and N. Sahu, 15257, 15309 (LWU). Governer Sholai, 2,200 m, 2002, Coll.: P.K. Verma, A. Alam and N. Sahu, 15470, 15471, 15478 (LWU). Gudulur, Devala, 1,300 m, 2002, Coll.: P.K. Verma and A. Alam, 16022 (LWU).

This is one of the common species of *Microlejeunea* distributed widely not only in India but across the world (Schuster 1980). The species is characterized by up to 10 mm long and 0.3 mm wide plant, ovate leaves with rounded apex and 1-2 gynoecial innovations.

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REFERENCES

AGARWAL, A. (1986): Studies in Indian Lejeuneoideae. A monographic study. Ph. D. Thesis. Department of Botany, Lucknow University, Lucknow.

FURUKI, T. & M. MIZUTANI (1994): Checklist of Japanese Hepaticae and Anthocerotae,1993. *Proc. Bryol. Soc. Japan. 6*: 75-83.

GRADSTEIN, S.R. (1979): The genera of the Lejeuneaceae: past and present. Pp. 83-107. *In*: Clark, G.S.C. & J.G. Duckett (Eds): *Bryophytes Systematics*. Academic Press. London.

MITTEN, W. (1861): *Hepaticae Indiae Orientalis*: an enumeration of the Hepaticae of the East-Indies. *J. Proc. Linn. Soc. Bot. 5*: 385-392.

MIZUTANI, M. (1961): A revision of Japanese Lejeuneaceae. *J. Hattori Bot. Lab. 24*: 115-302.

MIZUTANI, M. (1971): *Lejeunea* from the Himalayan region. *J. Hattori Bot. Lab. 34*: 445-457.

MIZUTANI, M. (1979): Hepatics from eastern Nepal collected by Himalayan expedition of Chiba University in 1977. *J. Hattori Bot. Lab. 46*: 311-325.

SCHUSTER, R.M. (1980): The Hepaticae and Anthocerotae of North America. IV. Columbia University Press, New York & London. XVIII +1334 pp.

STEPHANI, F. (1915): *Species Hepaticarum 5*: 705-848. Geneve *et* Bale.

VANDEN BERGHEN, C. (1948): Genera des Lejeuneaceae. *Lejeunea. Mem. 6*: 1-159.

ZHU, R.L. & M.L. So (2001): Epiphyllous liverworts of China. *Nova Hedwigia Beih. 121*: 1-418.

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